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Gull et al.

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(54) **LOAD MANAGEMENT SYSTEM**

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(51) **Int. Cl.**

G05D 11/00	(2006.01)
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G05D 3/12	(2006.01)
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G05D 9/00	(2006.01)
G05D 23/00	(2006.01)

(52) **U.S. Cl.** **700/295**; 700/286; 700/276; 700/300

(58) **Field of Classification Search** 700/295, 700/287, 286, 22, 28, 31, 276, 278; 307/39; 361/90, 1

See application file for complete search history.

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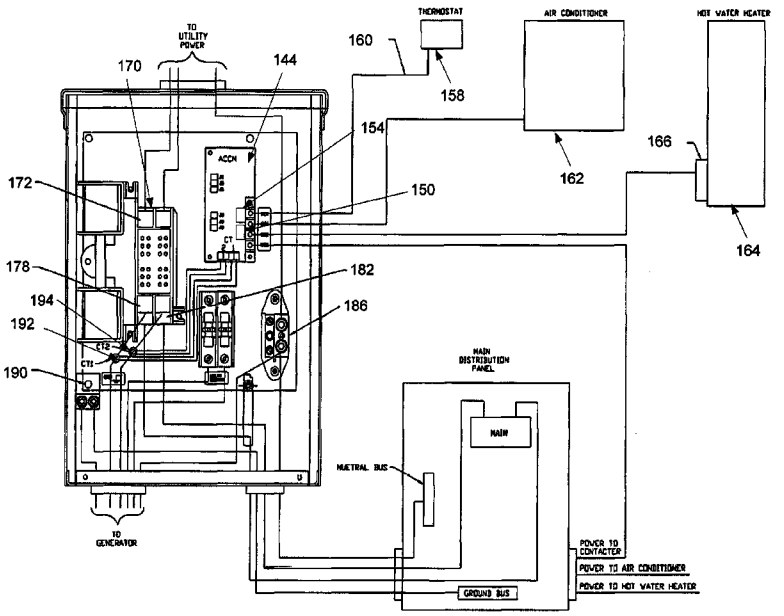
(57) **ABSTRACT**

A method, and a system that uses the method, of managing loads for residential use. The method includes connecting a first signal-responsive switch to a first load, and connecting a second signal-responsive switch to a second load that has a lower priority than the first load. The method also includes sensing first and second electrical signals from the respective first and second loads, and ensuring the first signal-responsive switch is in a CLOSED state and the second signal-responsive switch in an OPEN state after both a combination of the sensed first and second electrical signals exceeds a first threshold value and the sensed first electrical signal is below a second threshold value.

11 Claims, 11 Drawing Sheets



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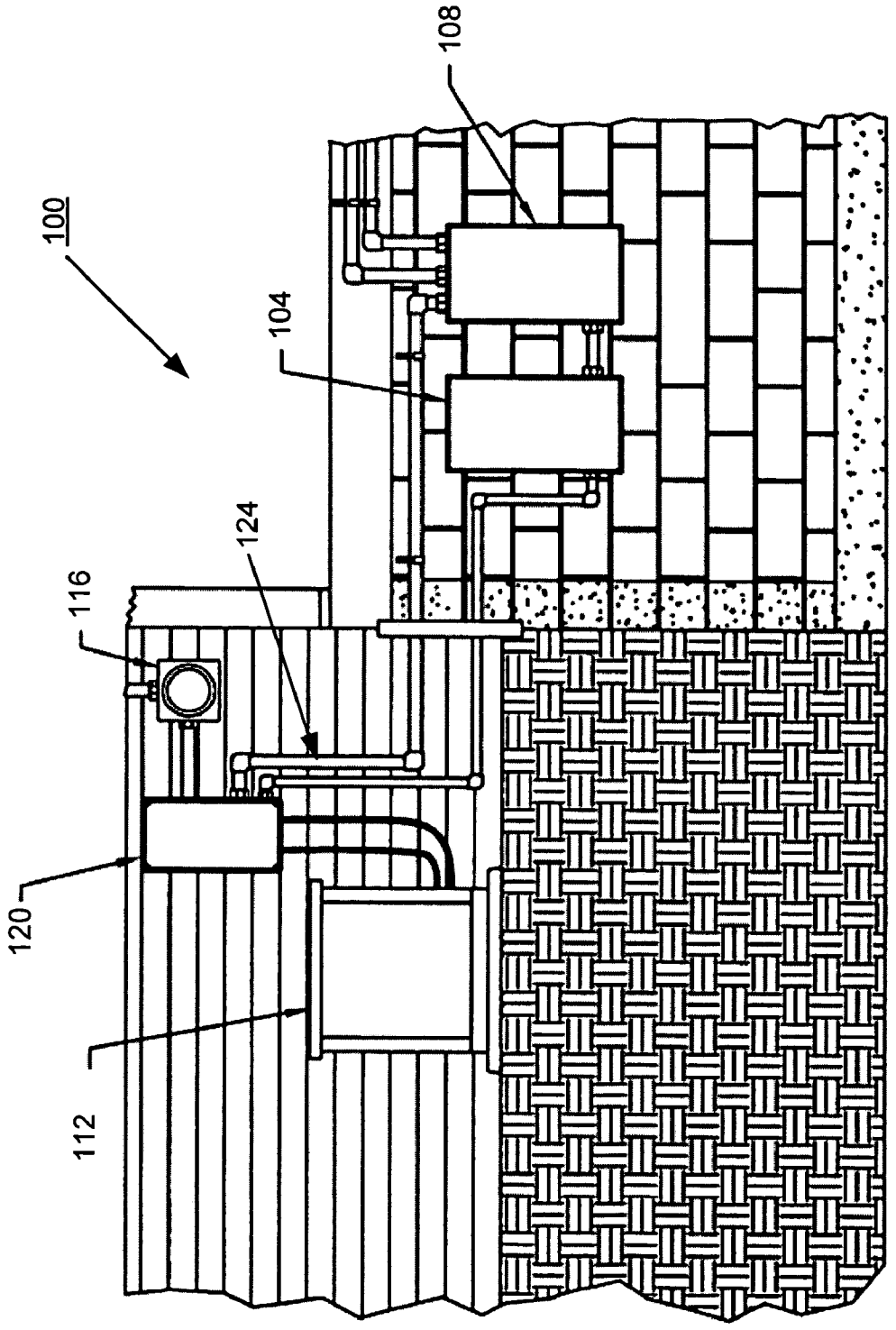

FIG. 1

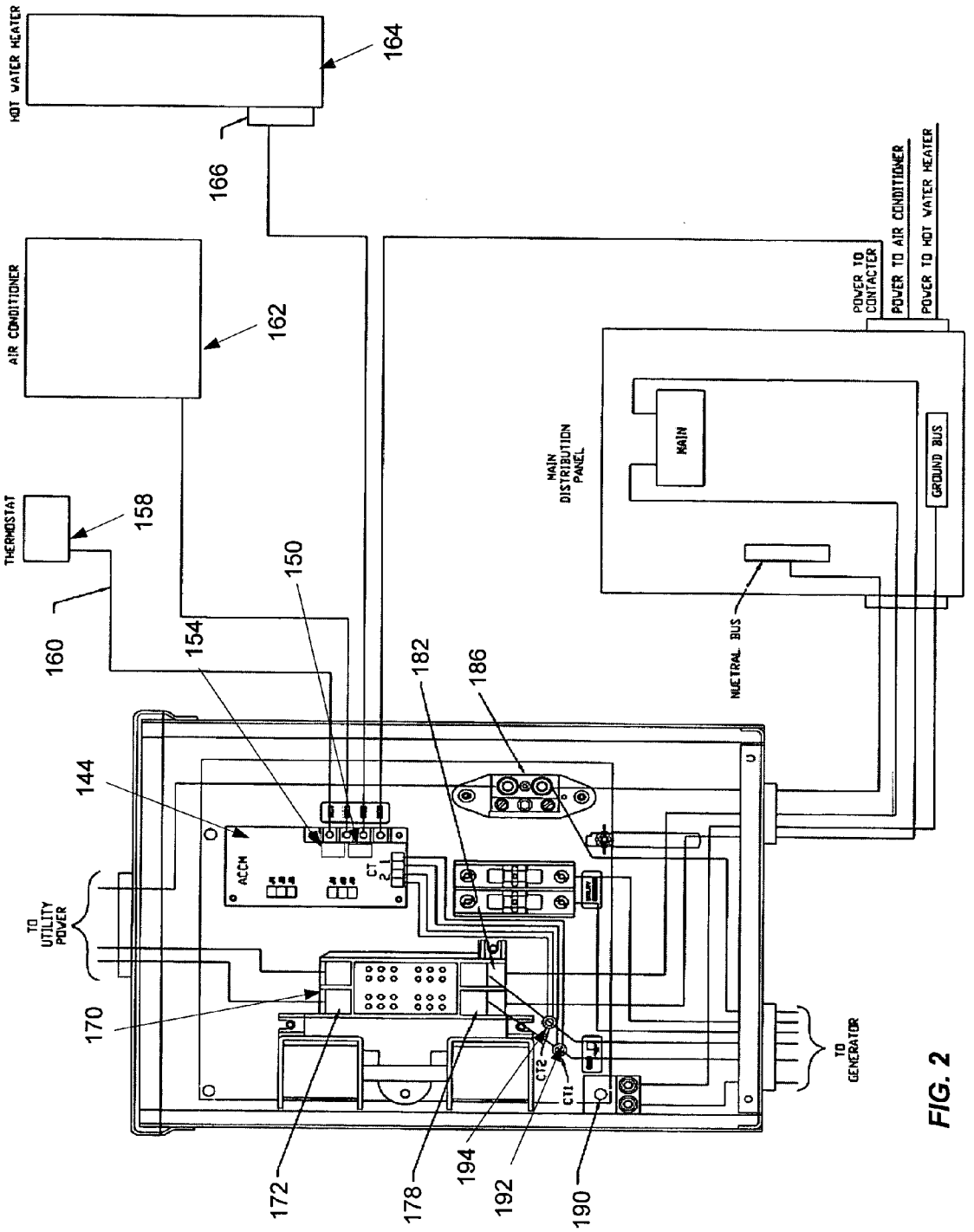
HOT WATER HEATER
164
166
AIR CONDITIONER
162
THERMOSTAT
158
160
154
150
MAIN DISTRIBUTION PANEL
MAIN
GROUND BUS
NEUTRAL BUS
POWER TO CONTACTER
POWER TO AIR CONDITIONER
POWER TO HOT WATER HEATER
182
186
144
ACCM
CT 1
CT 2
TO UTILITY POWER
170
CT2
CT1
TO GENERATOR
172
178
194
192
190

FIG. 2

FUEL	10 KW	12 KW	15 KW	17 KW
LP	41.7 A	50 A	62.5 A	70.8 A
NG	37.5 A	45.8 A	58.3 A	TBA

300

FIG. 3

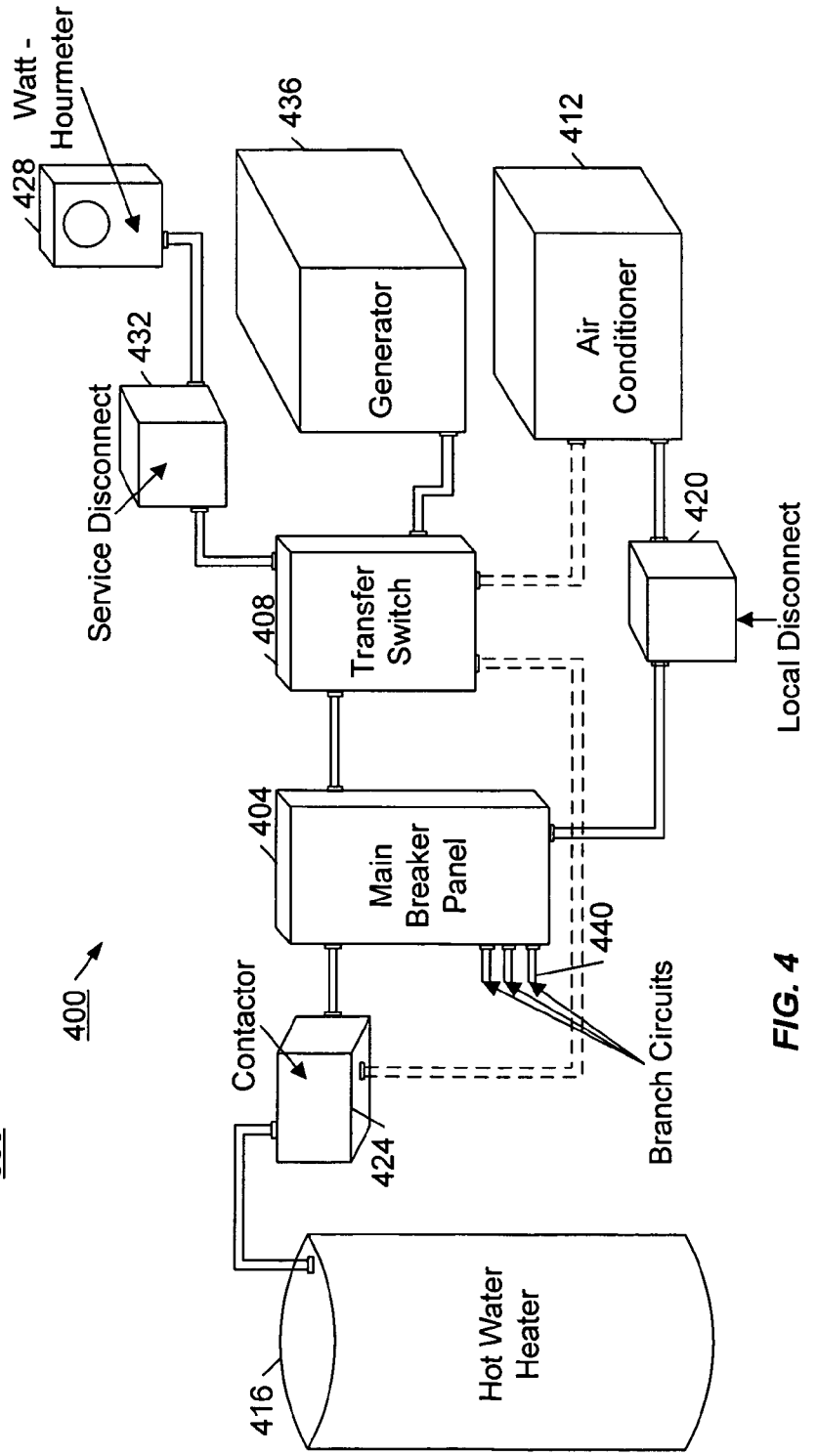

FIG. 4

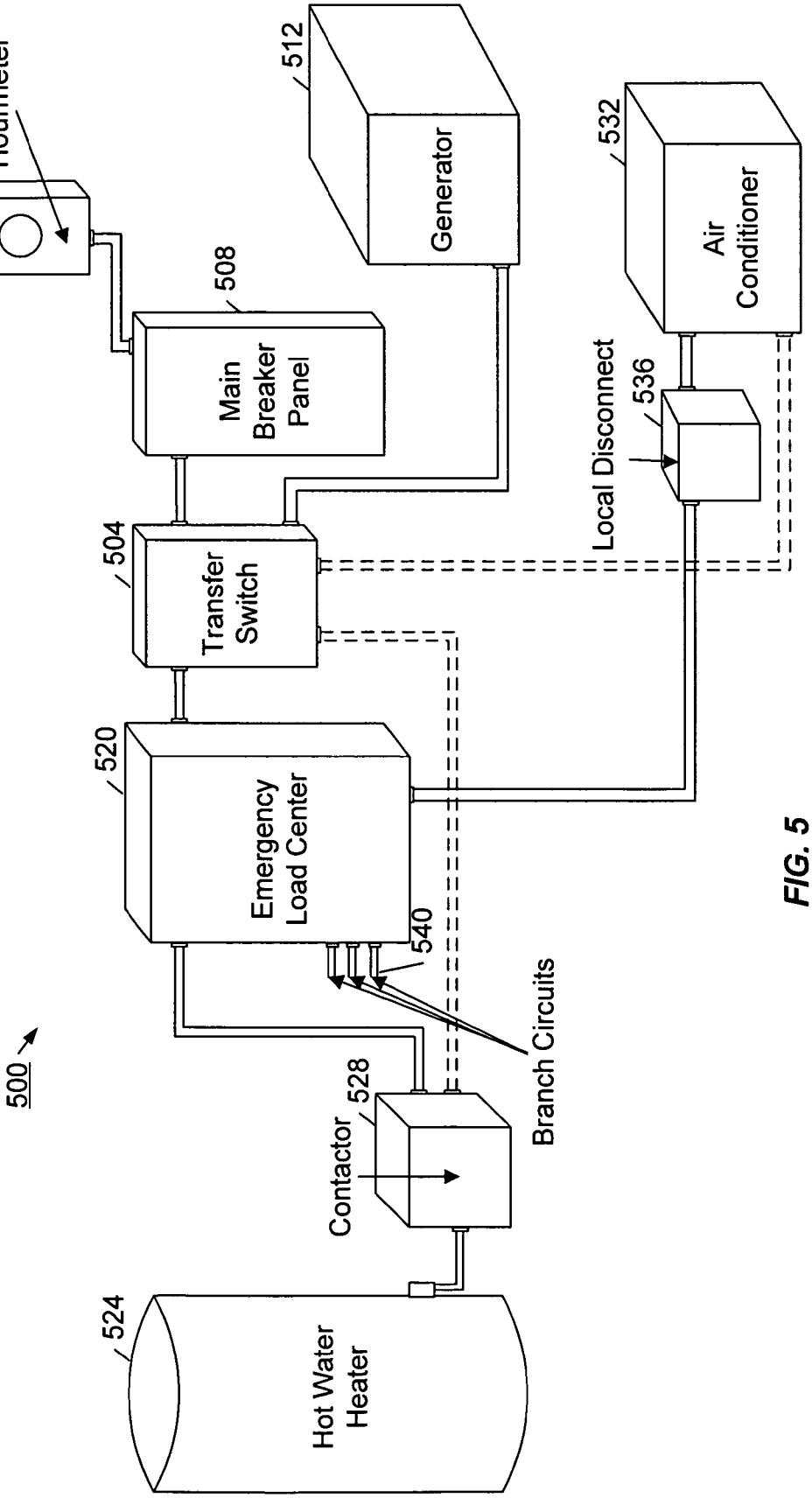
500
516 Watt - Hourmeter
512 Generator
532 Air Conditioner
508 Main Breaker Panel
536 Local Disconnect
504 Transfer Switch
520 Emergency Load Center
540 Branch Circuits
528 Contactor
524 Hot Water Heater

FIG. 5

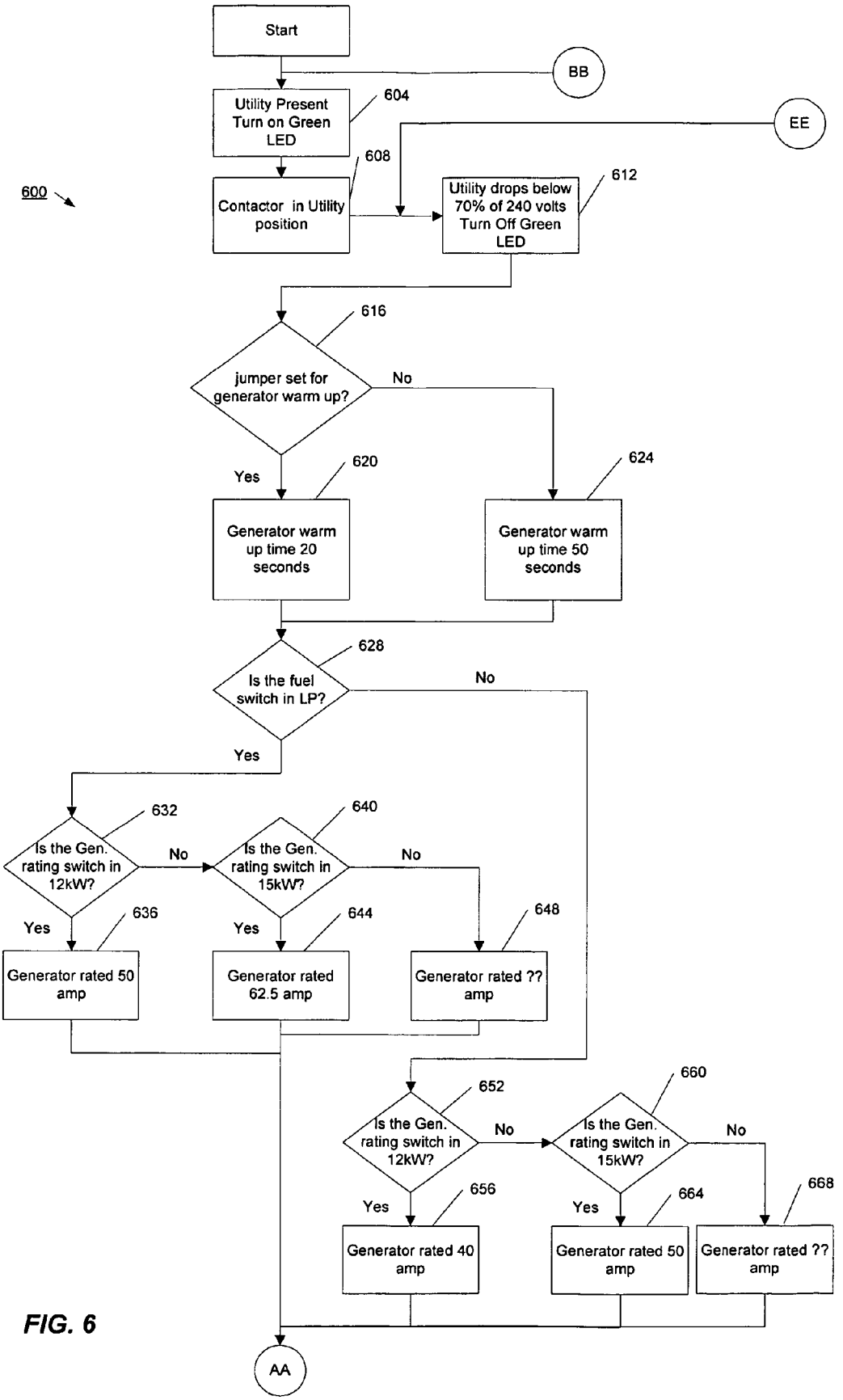
600
Start
BB
Utility Present Turn on Green LED
604
EE
608
Contactor in Utility position
612
Utility drops below 70% of 240 volts Turn Off Green LED
616
jumper set for generator warm up?
No
Yes
620
Generator warm up time 20 seconds
624
Generator warm up time 50 seconds
628
Is the fuel switch in LP?
No
Yes
632
Is the Gen. rating switch in 12kW?
No
640
Is the Gen. rating switch in 15kW?
No
Yes
636
Generator rated 50 amp
Yes
644
Generator rated 62.5 amp
648
Generator rated ?? amp
652
Is the Gen. rating switch in 12kW?
No
660
Is the Gen. rating switch in 15kW?
No
Yes
656
Generator rated 40 amp
Yes
664
Generator rated 50 amp
668
Generator rated ?? amp
AA

FIG. 6

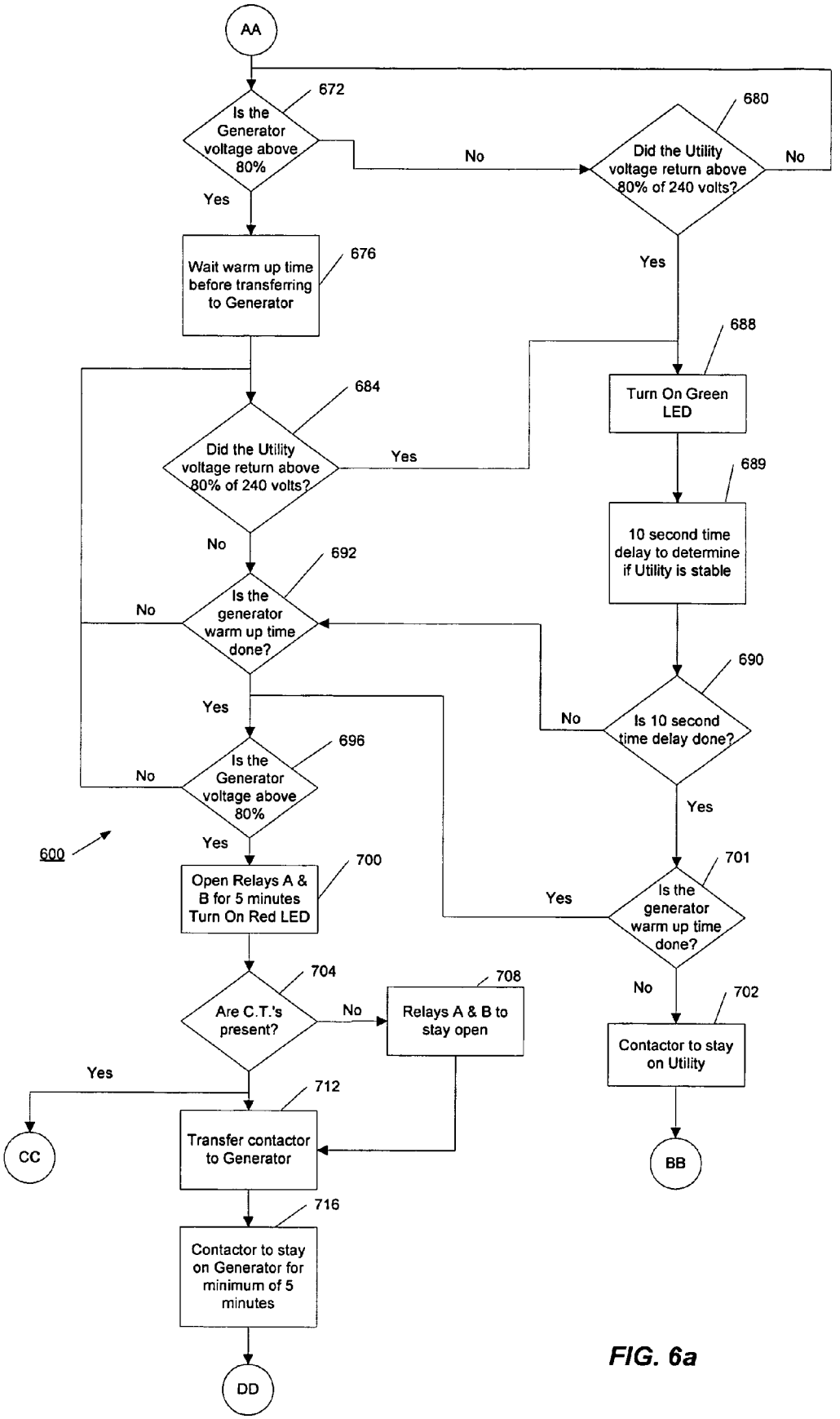
AA
672
Is the Generator voltage above 80%
No
680
Did the Utility voltage return above 80% of 240 volts?
No
Yes
Yes
Wait warm up time before transferring to Generator
676
688
Turn On Green LED
684
Did the Utility voltage return above 80% of 240 volts?
Yes
689
10 second time delay to determine if Utility is stable
No
692
Is the generator warm up time done?
No
690
Is 10 second time delay done?
No
Yes
Yes
696
Is the Generator voltage above 80%
No
600
Yes
Yes
701
Is the generator warm up time done?
700
Open Relays A & B for 5 minutes Turn On Red LED
Yes
704
Are C.T.'s present?
No
708
Relays A & B to stay open
No
702
Contactor to stay on Utility
Yes
712
Transfer contactor to Generator
CC
BB
716
Contactor to stay on Generator for minimum of 5 minutes
DD

FIG. 6a

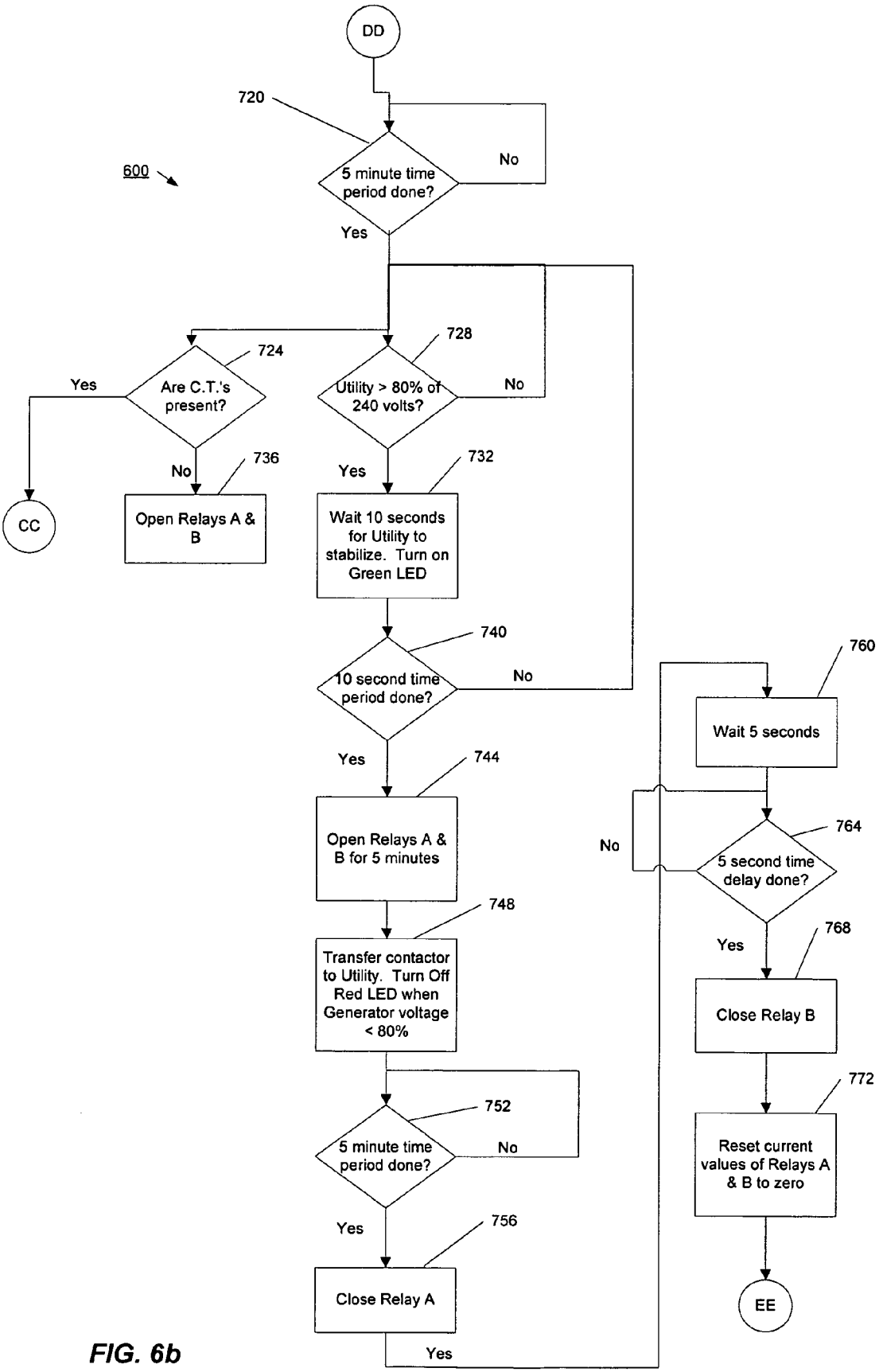
DD
720
600
5 minute time period done?
No
Yes
724
Are C.T.'s present?
Yes
No
736
Open Relays A & B
CC
728
Utility > 80% of 240 volts?
No
Yes
732
Wait 10 seconds for Utility to stabilize. Turn on Green LED
740
10 second time period done?
No
Yes
744
Open Relays A & B for 5 minutes
748
Transfer contactor to Utility. Turn Off Red LED when Generator voltage < 80%
752
5 minute time period done?
No
Yes
756
Close Relay A
Yes
760
Wait 5 seconds
764
5 second time delay done?
No
Yes
768
Close Relay B
772
Reset current values of Relays A & B to zero
EE

FIG. 6b

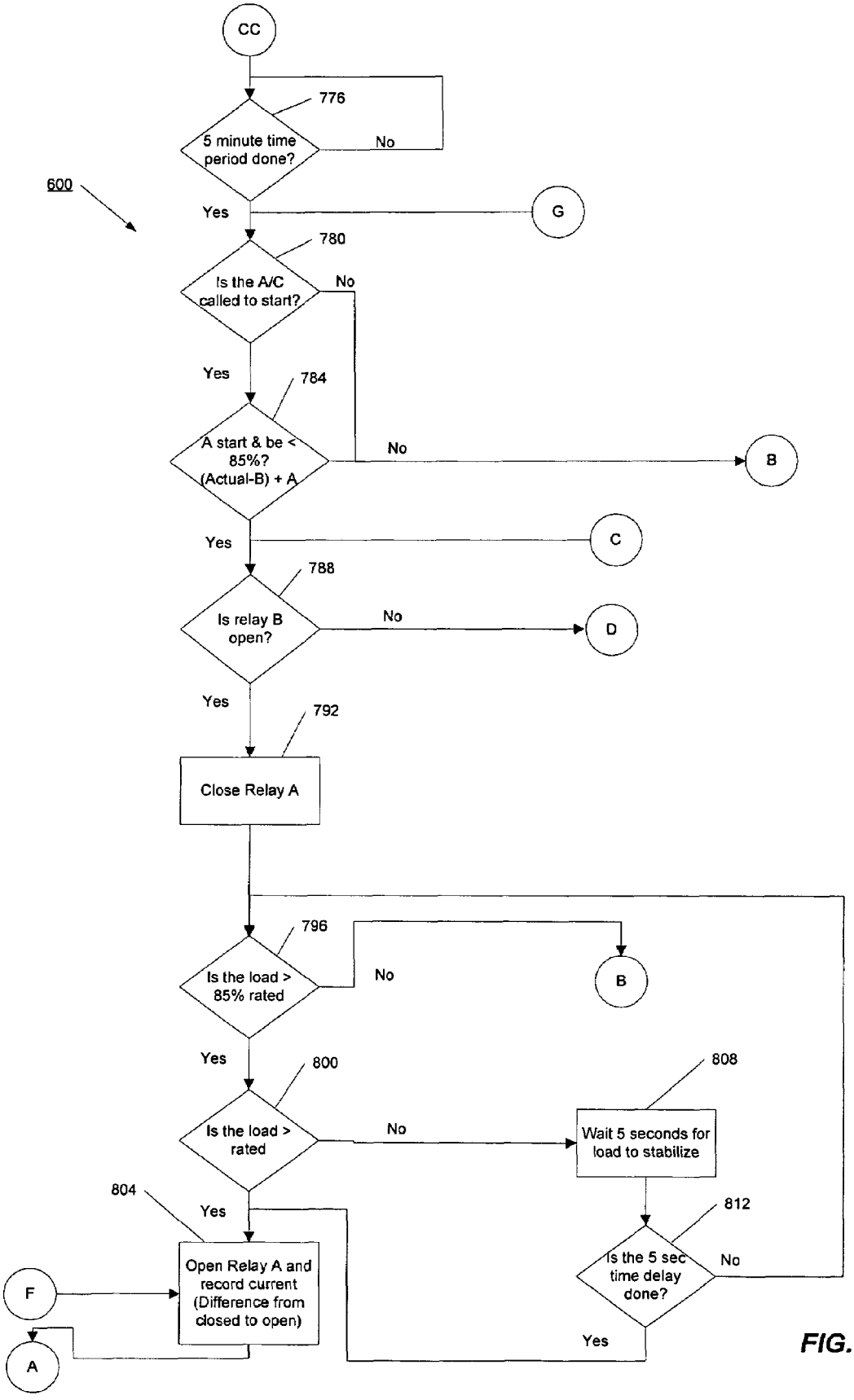
CC
776
5 minute time period done?
No
600
Yes
G
780
Is the A/C called to start?
No
Yes
784
A start & be < 85%? (Actual-B) + A
No
B
Yes
C
788
Is relay B open?
No
D
Yes
792
Close Relay A
796
Is the load > 85% rated
No
B
Yes
800
Is the load > rated
No
808
Wait 5 seconds for load to stabilize
804
Yes
812
Is the 5 sec time delay done?
No
Yes
Open Relay A and record current (Difference from closed to open)
F
A

FIG. 6c

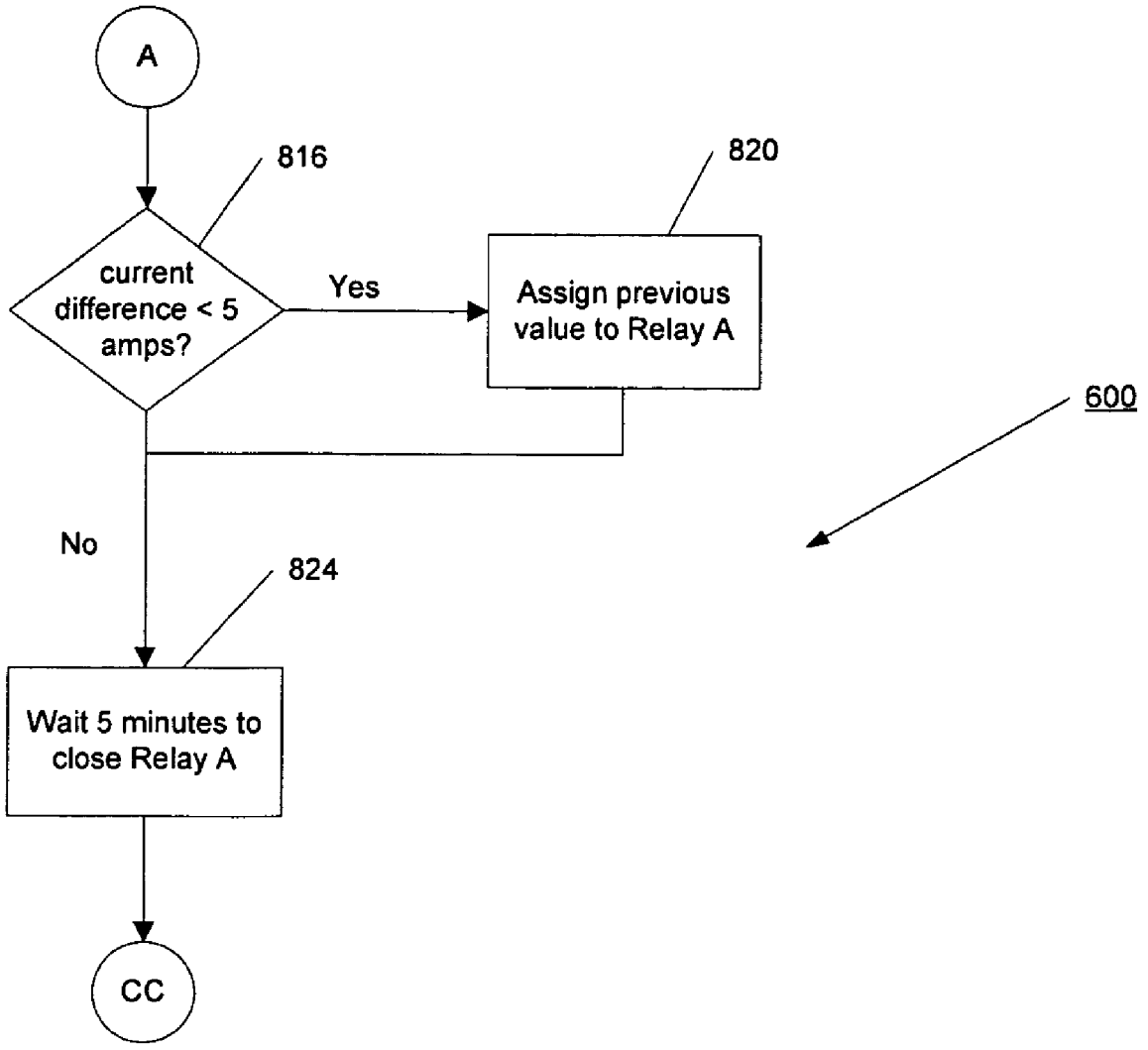
A
816
820
current difference < 5 amps?
Yes
Assign previous value to Relay A
600
No
824
Wait 5 minutes to close Relay A
CC

FIG. 6d

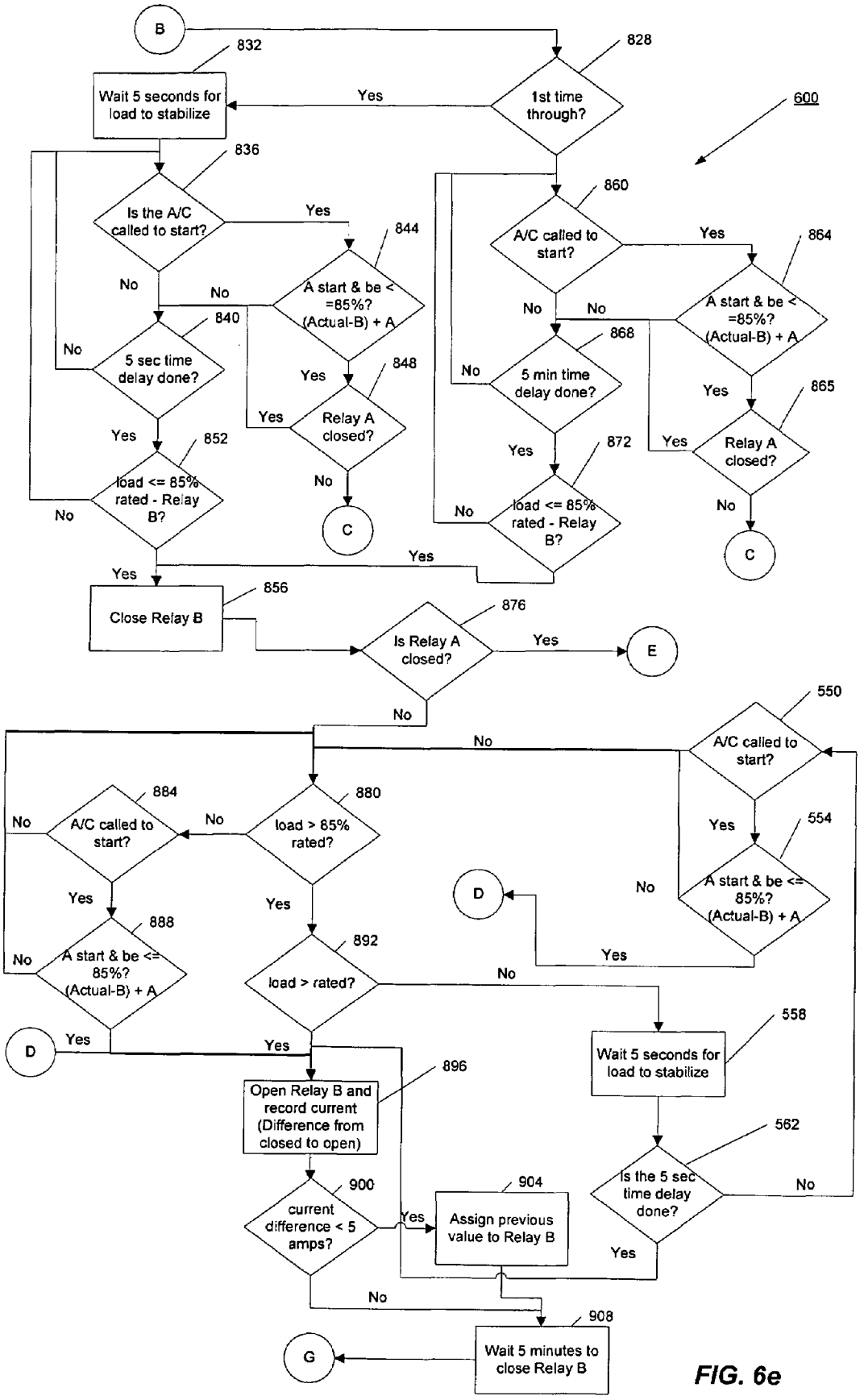
B
832
Wait 5 seconds for load to stabilize
Yes
828
1st time through?
600
836
Is the A/C called to start?
Yes
844
A start & be < =85%? (Actual-B) + A
No
No
840
5 sec time delay done?
No
Yes
848
Relay A closed?
Yes
852
load <= 85% rated - Relay B?
No
C
No
Yes
Yes
856
Close Relay B
860
A/C called to start?
Yes
864
A start & be < =85%? (Actual-B) + A
No
No
868
5 min time delay done?
No
Yes
865
Relay A closed?
Yes
872
load <= 85% rated - Relay B?
No
C
876
Is Relay A closed?
Yes
E
No
550
A/C called to start?
No
Yes
554
A start & be <= 85%? (Actual-B) + A
No
D
Yes
884
A/C called to start?
No
880
load > 85% rated?
No
Yes
Yes
888
A start & be <= 85%? (Actual-B) + A
No
892
load > rated?
No
D
Yes
Yes
558
Wait 5 seconds for load to stabilize
896
Open Relay B and record current (Difference from closed to open)
562
Is the 5 sec time delay done?
No
Yes
900
current difference < 5 amps?
Yes
904
Assign previous value to Relay B
No
908
Wait 5 minutes to close Relay B
G

FIG. 6e

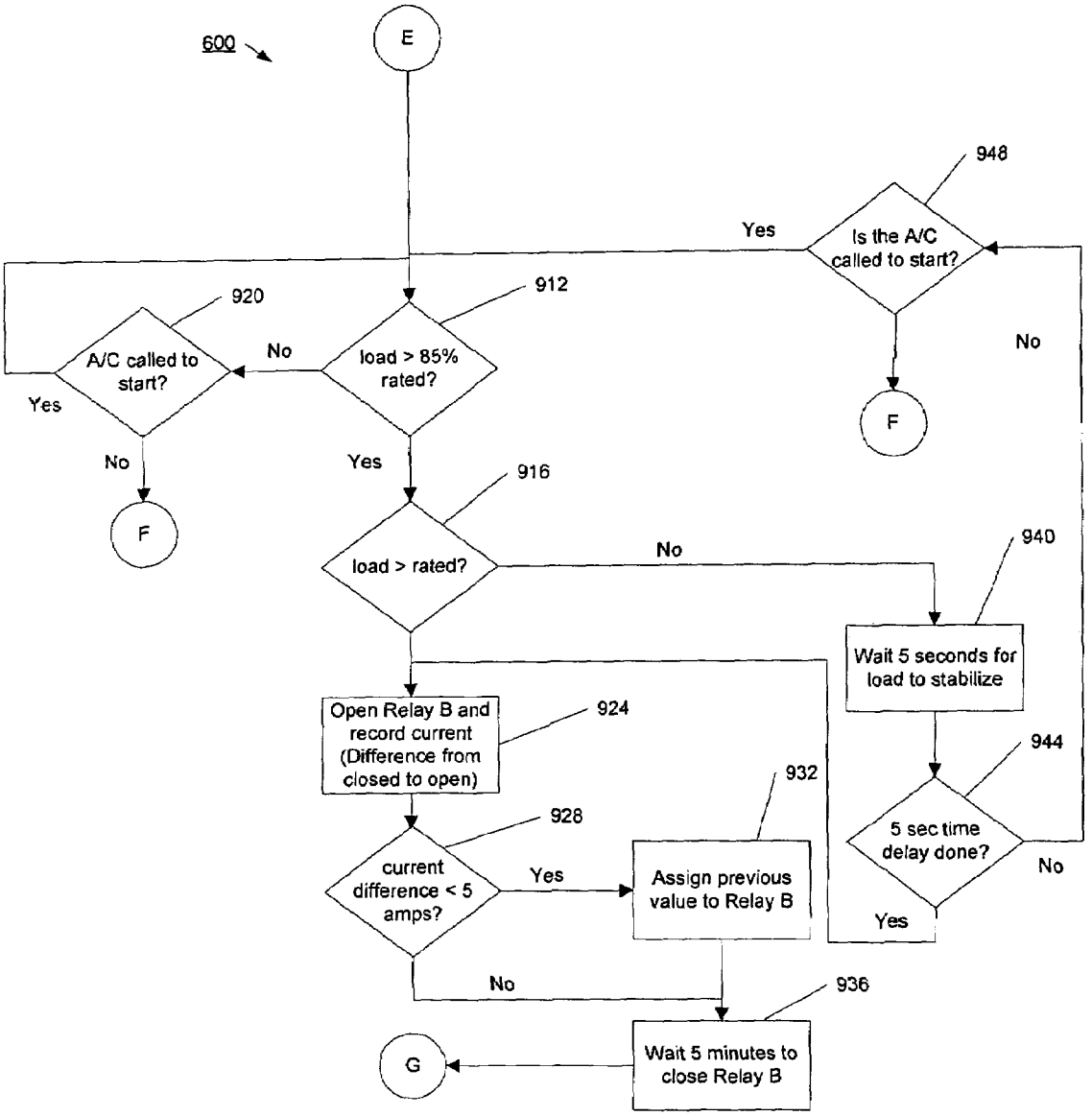
600
E
948
Is the A/C called to start?
Yes
No
912
load > 85% rated?
920
A/C called to start?
No
Yes
No
F
Yes
F
916
load > rated?
No
940
Wait 5 seconds for load to stabilize
Open Relay B and record current (Difference from closed to open)
924
944
5 sec time delay done?
No
Yes
932
928
current difference < 5 amps?
Yes
Assign previous value to Relay B
No
936
Wait 5 minutes to close Relay B
G

FIG. 6f

LOAD MANAGEMENT SYSTEM

RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/588,073, filed on Jul. 15, 2004, and U.S. Provisional Patent Application No. 60/676,392 filed on Apr. 29, 2005; and is a continuation-in-part of U.S. patent application Ser. No. 11/086,167, filed on Mar. 22, 2005, entitled "Residential Load Power Management System", and assigned to the assignee of this application, all of which applications are incorporated by reference herein.

BACKGROUND

The invention relates to power management, and more particularly, to residential power management.

When there is a residential power outage, back up power may be provided by a standby generator. In some cases, the standby generator is started automatically after the power outage. A standby generator that can be started automatically usually requires an automatic transfer switch. The combination of a standby generator and an automatic transfer switch is generally expensive. In some other cases, the standby generator will normally be turned on either manually or automatically to provide a limited amount of power to the residence due to an amperage limit of the standby generator. Therefore, only limited power is provided to the residence with some standby generators. In other words, a standby generator with a low amperage rating can limit the types of and number of appliances connected to the standby generator. Exemplary appliances that draw large amounts of current include air conditioners, hot water heaters, and on-demand appliances such as microwave ovens and toasters.

Standby back up generators and automatic transfer switches are also known. However, standby back up generators with low power ratings can still be overloaded when more power is demanded than can be supplied by the generators. Furthermore, standby back up generators with high power ratings are much more costly.

SUMMARY

The invention provides a load management system for managing a plurality of loads in a residence. The load management system includes at least one current transformer configured to monitor current input from a standby or portable generator. The load management system also includes a plurality of fuel type switches and generator rating switches. The fuel type switches allow a user or an operator to select a fuel type used by the generator at installation. Similarly, the generator rating switches allow the operator to select a generator rating of the generator at installation. The load management system also includes a plurality of prioritized relays having the same power ratings. Settings of the switches, and relay priorities are fixed at installation by the operator. Having the same power ratings at all relays simplifies the installation process. When a high demand appliance is connected to the system while the system is already fully loaded, contacts connecting the standby generator to the appliance will remain open until another high demand load is automatically or manually disconnected. The operator therefore manually decides the priority of at least some of the loads in the residence.

In one form, the invention provides a load management system for residential use. The system includes first and second signal-responsive switches that are connected to respective first and second loads, a sensor that senses first and second electrical signals from the respective first and second loads, and a controller. The first signal-responsive switch has a first priority; and the second signal-responsive switch has a second priority that is lower than the first priority. The controller ensures that the first signal-responsive switch is in a CLOSED state and the second signal-responsive switch is in an OPEN state after the sensor has sensed that a combination of the first and second electrical signals exceeds a first threshold value and that the first electrical signal is below a second threshold value.

In another form, the invention provides a method of managing loads for residential use. The method includes connecting a first signal-responsive switch to a first load, and connecting a second signal-responsive switch to a second load that has a lower priority than the first load. The method also includes sensing first and second electrical signals from the respective first and second loads, and ensuring the first signal-responsive switch is in a CLOSED state and the second signal-responsive switch in an OPEN state after both a combination of the sensed first and second electrical signals exceeds a first threshold value and the sensed first electrical signal is below a second threshold value.

While standby backup generator systems that manage load capacity and control an associated transfer switch are generally known, these backup systems are typically used in commercial settings such as offices, and can be costly. These backup systems generally require complicated installation procedures, and offer more features than an average residence can utilize. Some of the offered features and functions can also be impractical for the average residence. Furthermore, frequencies and durations of power outages in an average residence are low and short in general, respectively. As a result, an average residence will find it hard to justify the expense for these standby generator systems and for the functions and features that are unnecessary.

Thus, the invention provides the average residence with systems that offer the convenience of being able to manage a limited or reduced number of loads such as an air conditioning unit and a hot water heater, without the expense of more complicated systems. For example, the average residence may control a maximum of two high-load appliances with the present system. Since the present invention is less complicated, fewer parts are used which then reduces the cost of manufacturing and the price.

The systems according to the present invention may also include inexpensive jumpers and/or switches that allow for connection with different generators with different ratings and fuel types. All of these aspects lower the cost for the systems according to the present invention, making the systems more appealing and practical for the average residence. In other words, the systems offer flexibility while providing some of the functions that are suitable for average residences at relatively lower costs, and are less complicated than expensive, commercial load management systems.

Other features and advantages of the invention will become apparent to those skilled in the art upon review of the following detailed description, and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a residential electrical system having a load management system.

FIG. **2** is a system block diagram of the load management system depicted in FIG. **1**.

FIG. **3** is a fuel power table for the load management system depicted in FIG. **1**.

FIG. **4** is a second residential electrical system having a load management system.

FIG. **5** is a third residential electrical system having a load management system.

FIG. **6** is a flow chart of processing carried out in embodiments of the invention.

FIG. **6***a* is a continuation of the flow chart of FIG. **6**.

FIG. **6***b* is a continuation of the flow chart of FIG. **6***a*.

FIG. **6***c* is a continuation of the flow chart of FIG. **6***b*.

FIG. **6***d* is a continuation of the flow chart of FIG. **6***c*.

FIG. **6***e* is a continuation of the flow chart of FIG. **6***d*.

FIG. **6***f* is a continuation of the flow chart of FIG. **6***e*.

DETAILED DESCRIPTION

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms "connected," "coupled," and "mounted" and variations thereof herein are used broadly and encompass direct and indirect connections, couplings, and mountings. In addition, the terms "connected" and "coupled" and variations thereof are not restricted to physical or mechanical connections or couplings.

As should also be apparent to one of ordinary skill in the art, the systems depicted in the figures are models of what actual systems might be like. As noted, many of the modules and logical structures described are capable of being implemented in software executed by a microprocessor or a similar device or of being implemented in hardware using a variety of components including, for example, application specific integrated circuits ("ASICs"). Terms like "controller" may include or refer to both hardware and/or software. Furthermore, throughout the specification capitalized terms are used. Such terms are used to conform to common practices and to help correlate the description with the coding examples, equations and/or drawings. However, no specific meaning is implied or should be inferred simply due to the use of capitalization. Thus, the claims should not be limited to the specific examples or terminology or to any specific hardware or software implementation or combination of software or hardware.

Embodiments of the invention relate to a method and system for managing loads powered by a home or residential generator in an event of utility power outage. The system adds and sheds a prioritized load based on the electrical power, voltage, and current generated by the generator, and also based on the electrical power, voltage, and current demanded by the loads in the residence. In one specific embodiment, the system determines the electrical power, voltage, and current generated by the generator from switch settings, monitors the electrical power, voltage, and current demands from the loads, and adds or sheds the loads based on some predetermined parameters.

FIG. **1** depicts a load management system **100** disposed in a residence embodying the invention. The load management system **100** includes a load shed center **104** that is connected to a breaker box or a load distribution panel **108**. Power from sources such as a home standby generator or a portable generator **112** and a utility source **116** is connected to a junction box or a transfer switch **120** outside of the residence. In some embodiments, the transfer switch **120** can be installed inside the residence. The transfer switch **120** is also connected to the load shed center **104** and the breaker box **108** via a plurality of conduits **124**. The operation of the load management system **100** is detailed hereinafter.

In some embodiments, the load management system **100** also includes a load-management-control board in the transfer switch **120**. Alternatively, the load-management-control board can also be implemented in the load shed center **104**, or the breaker box **108**. FIG. **2** depicts a schematic view of the transfer switch **120** that includes a load-management-control board **144** which is connected to a thermostat **158** via a thermostat control wire or a thermostat control conductor **160**. The load-management-control board **144** is connected to some high power consumption loads such as an air conditioner **162** and a hot water heater **164** via a contactor **166**. Furthermore, the transfer switch **120** also includes a second contactor **170** that receives power from the utility source **116** at a utility connection **172**, and from the standby generator **112** at a generator connection **178**. The contactor **170** also has a load connection **182** that is connected to the loads such as the air conditioner **162** and the hot water heater **164**. The transfer switch **120** also includes a neutral terminal **186** for connecting to the neutral inputs of the generator **112** and of the utility source **116**, and a ground lug **190** for proper electrical protection.

To provide power from either the generator **112** or the utility source **116** to the loads such as the air conditioner **162** and the hot water heater **164**, the load-management-control board **144** includes a plurality of prioritized relays **150**, **154**. In some embodiments, when the utility source **116** is supplying power to the residence, relays **150** and **154** are not energized, and a plurality of contacts remain in a normally closed position. However, when there is a utility power outage, the load-management-control board **144** takes control of the relays **150** and **154**. That is, after the utility source **116** fails, the load-management-control board **144** starts to transfer to generator power. Specifically, the load-management-control board **144** monitors both incoming generator lines through a pair of current transformers ("CT's") **192** and **194**, and determines if there is enough power available to start the air conditioner ("A/C") or other large loads by the generator **112**.

Depending on the position of a fuel source dip switch for liquid propane ("LP") or natural gas ("NG"), the load-management-control board **144** can determine that the generator **112** is either operating at rated wattage with LP or a reduced wattage with NG, as listed in FIG. **3**. When one of the current transformers ("CT's") **192**, **194** detects a current reaching or approaching a first percentage amount, for example 85 percent, or 30 A, of rated load capacity, the load-management-control board **144** energizes or opens the relay **150** or **154**. In this way, the load-management-control board **144** can start shedding loads based on the lowest priority and advances to the highest priority. The priorities are typically fixed at installation, with relay **150** or "A/C" being the last to shed, and the first to be added, and the relay **154** or hot water heater or other large loads being the first to shed and the last to be added.

In some other embodiments, the load-management-control board **144** also monitors the current at the relays **150** and **154** demanded by the loads such as the air conditioner **162** and the hot water heater **164**. In this way, the priority or the sequence of load shedding and adding can be adjusted based upon the actual demands from the loads. For example, if the relay **150** is idle or not asking for or demanding any current, the load-management-control board **144** can close the relay **154**.

In some embodiments, the load-management-control board **144** also controls the transfer switch **120**. The transfer switch **120** monitors a utility voltage, and determines when the utility power **116** is not present or at a low level when compared with a predetermined threshold. For example, when the load-management-control board **144** senses that the generator **112** has been started, the load-management-control board **144** will start to control the current supplied to the loads through the relays **150**, **154**. After the generator **112** is running or operating at a rated speed and voltage for a predetermined amount of time delay, the second contactor **170** transfers power from the utility source **116** to the generator **112**. Typically, the time delay is between 30 seconds and 50 seconds. However, the time delay may be longer in a colder region in which the generator **112** may take longer to warm up, or shorter in a warmer region in which the generator **112** may warm up faster.

Once the generator **112** is supplying power, the load-management-control board **144** will transfer the generator power to the loads. The load-management-control board **144** checks to ensure that power from the generator **112** is supplied to the loads for a predetermined minimum amount of time, such as five minutes. In some embodiments, the load-management-control board **144** can also be configured to perform reverse monitoring. For example, when the load-management-control board **144** senses that the utility power **116** has been restored, the load-management-control board **144** will also monitor the utility power for a period of time, and will transfer the loads to utility power once the utility source **116** has stabilized. In some embodiments, when the power transfers from the utility source **116** to the generator **112**, the load-management-control board **144** ensures that the transfer will last for a predetermined minimum amount of time, such as five minutes. These minimum time periods avoid some power transfers if the utility power flickers on and off.

In yet other embodiments, the relays **150** and **154** are usually kept closed when utility power is supplied. However, during a power outage, the relays **150** and **154** may be automatically opened to ensure that no power is provided to any connected loads thereby protecting the loads, the generators, and any associated electronics from an instantaneous overload if the managed loads are drawing power when generator power is first supplied. The relays **150** and **154** can be controlled by some normally closed contacts. In such a case, the contacts keep the relay **150** and **154** closed when the utility power is supplied. However, the solenoid will be de-energized or deactivated such that the relay contacts **150** and **154** are opened when the load-management-control board **144** senses that the utility power from the utility source **116** is not available. Alternatively, normally closed relays could be used, and the relays **150** and **154** would open when generator power is available. Furthermore, if the load-management-control board **144** is configured to react to a power outage fast enough, the relays **150** and **154** can be configured to be kept closed even when a power outage occurs.

In some embodiments, when powered by the generator **112**, the load-management-control board **144** can manage two protected circuits such as the air conditioner **162** and the hot water heater **164**. For example, the load-management-control board **144** monitors and records a total amount of current drawn by the loads or appliances applied in the building such that the total amount of current drawn by these loads or appliances is below some limit, which may be fixed or adjustable. Furthermore, the load-management-control board **144** is generally housed in either a NEMA 1 or NEMA 3R enclosure, which is rated for operational temperatures from −32° F. to 104° F. Although two types of enclosures may be used, other enclosures that satisfy other technical requirements can also be used.

Furthermore, the load-management-control board **144** through the CT's **192**, **194** monitors the incoming lines and manages the total current drawn at or below a preset maximum amount, for example, 85 percent, of the rated load of the generator **112**. The load-management-control board **144** generally includes some memory that stores the preset amounts, among other things.

The load-management-control board **144** also monitors a plurality of power-related switches such as the set of power rating switches or jumpers, and the set of fuel type switches or jumpers. In some embodiments, the jumpers and the switches are positioned on the load-management-control board **144**. Alternatively, the jumpers and the switches are positioned in the transfer switch **120**. The optional power rating switches allow an operator to switch between a plurality of generator output powers, for example, 10 Kilowatts ("KW"), 12 KW, 15 KW, or 17 KW. Of course, other generators with different output powers can also be used.

In some other embodiments, the load-management-control board **144** does not include any power rating switches. That is, the load-management-control board **144** is set for a particular power rating, for example, 12 KW. The load-management-control board **144** that offers only a set power rating thus yields a lower cost embodiment. Of course, other parts can also be eliminated to lower the cost, detailed hereinafter.

Similar to the power rating switches and jumpers, the load-management-control board **144** in some embodiments also provides a plurality of fuel type switches that allow an operator to select from a plurality of fuel types such as LP and NG to be provided to the generator **112**. Although LP and NG are listed as the fuel types that the operator is to select from, other fuel types such as gasoline, diesel, and the like can also be used, depending on the fuel requirements of the generator **112**. In this way, the load-management-control board **144** can also be used in a variety of applications to reduce overall manufacturing cost.

Depending on the fuel type, a generator **112** operates either at a rated wattage, or at a reduced wattage, as described. In some embodiments, the generator **112** fueled by LP provides more power, wattage, or current than the same generator **112** fueled by NG. Particularly, FIG. **3** depicts a fuel power table **300** listing a plurality of current amounts generated by differently-rated generators fueled by different fuel types. The table **300** lists, for example, that a generator rated at 10 KW fueled by LP produces 41.7 A, which is 4.2 A more than the same generator but fueled by NG. The load-management-control board **144** then monitors the incoming lines through the CT's **192**, **194** based on the settings of the power-related switches and the fuel type switches. Also, the CT's **192**, **194** typically have the same ratings. However, the CT's **192**, **194** can also have different ratings depending on design or user requirements.

When the CT's **192** or **194** on any line starts to detect that the current drawn reaches a preset maximum amount of the rated load, the load management system **100** starts to operate. Controllers for load shedding are well known in the art, such as those depicted in U.S. Pat. Nos. 4,499,385, 4,617,472, 6,652,330, and 6,507,164, which are incorporated herein by reference.

Under utility power from the utility source **116**, the load-management-control board **144** is generally in a sleep mode. When the utility source **116** fails to supply power, the load-management-control board **144** enters a power transfer mode, in which power is transferred from the utility source **116** to the generator **112**. Once in the power transfer mode, the load-management-control board **144** starts to manage and to control the loads that have corresponding relays.

As described, the load-management-control board **144** monitors both incoming lines from the generator **112**, and tries to keep the generator **112** loaded below a preset maximum amount of generator load capacity. Depending on which one of the LP and NG switches is set, the generator **112** is either operating at rated wattage or at a reduced wattage. The load-management-control board **144** will determine the output power of the generator **112** based on the power rating switch or any preset power rating, and the fuel types positions. When the CT's **192**, **194** on any of the power lines from the generator **112** detects that the current generated and drawn reaches the preset maximum current amount, the load-management-control board **144** starts to shed loads based on a predefined priority, from a low priority to a high priority, or from a second priority to a first priority, which is detailed below.

A load is shed by simply opening the relay contacts for the load at the respective relays **150**, **154**, and by keeping the relays **150**, **154** in an OPEN state until the sensed current from the generator **112** is sufficiently below the preset maximum amount. When the sensed current has dropped sufficiently, the relay **150**, **154** can be closed and current is supplied from the generator **112** to the loads when a demand signal (e.g. from a thermostat for the load) is present.

Generally, the preset maximum amount is 85 percent, although other percentages can also be used. When the total current drawn drops to a second preset amount of rated load, the load-management-control board **144** will start to add a load based on the higher or the first priority relay **150** first, followed by the lower or the second priority relay **154**, until the load-management-control board **144** reaches the preset maximum amount. The load-management-control board **144** continues to operate this way until other situations such as the load-management-control board **144** switches back from the generator **112** to the utility position arise. The second preset amount is generally 60 percent, although other percentages can also be used.

For example, when the relay **150** is the first priority relay and is connected to the A/C **162**, when the relay **154** is the second priority relay and is connected to the hot water heater **164**, if both the A/C **162** and the hot water heater **164** are running and drawing a power of 70 percent of the maximum power or wattage capability determined by the load-management-control board **144**, and if an additional load such as a microwave oven starts to also demand power from the generator **112**, the microwave oven is likely to increase the total power demand to above 85 percent of the maximum power or wattage capability. As a result, contacts for the second relay **154** connected to the hot water heater **164** will be opened, and the first relay **150** will remain closed unless the total current drawn by the microwave oven and the A/C **162** is still more than the preset percentage of the maximum power or wattage capability with the relay **154** of the hot water heater **164** being in the OPEN state. After the microwave oven stops drawing power from the generator **112**, the contacts of the second relay **154** will be closed and thus adding the hot water heater **164** back.

When stepping loads on and off, the load-management-control board **144** waits for a preset amount of time, for example 5 seconds, before shedding or adding another prioritized load from or to the load-management-control board **144**. In this way, the load-management-control board **144** has time to stabilize. When the load-management-control board **144** sees or detects a large current swing in demand, the load-management-control board **144** sheds the loads more quickly to prevent the generator **112** from overloading. Once the demand has stabilized, the loads can be added again. Specifically, the load-management-control board **144** will start adding the applied load with the highest priority available. Thereafter, the load-management-control board **144** waits for another preset amount of time, for example 5 seconds, and adds the next priority load. The load-management-control board **144** will continue to add load until all loads have been added, or until the preset maximum amount of rated load has been reached.

In an alternate lower cost embodiment, the load-management-control board **144** does not perform current monitoring, and does not include any current transformers. Instead, the load-management-control board **144** simply opens the relay contacts **150**, **154** as soon as generator power is sensed. The relay contacts **150**, **154** are kept open until utility power is sensed. Any appliances such as the A/C **162** or the hot water heater **164** that is electrically connected to the relays **150**, **154** are locked out after the utility power from the utility source **116** has been restored. In such cases, the system **100** is less expensive since the CT's **192**, **194** are eliminated, and thus controlling the relays **150**, **154** is accordingly simplified.

In some other embodiments, the relays **150**, **154** are selected to search or look for a voltage source that can come from either the load-management-control board **144**, or the thermostat **158**. As described, the relays **150**, **154** are typically used to relay power to a load such as the A/C **162** and the hot water heater **164**. If the relays **150**, **154** have detected the activating (voltage or current) signal from the voltage source, the relays **150**, **154** will start examining or detecting a current drawn or power demanded by the connected loads.

In the example that follows, without limitation, the relay **150** controls the power being supplied to the A/C **162**, and the relay **154** controls the power being supplied to the hot water heater **164**. Particularly, when the relay **150** does not detect any signal during a power outage, the relay **150** will remain open. However, when the relay **150** has detected an activating (voltage or current) signal from the voltage source such as the thermostat **158**, the load-management-control board **144** can determine if there is enough power capacity to turn on or close the relay **150** to activate the A/C **162**. If there is not enough power capacity, the relay **150** will remain open regardless of the state of relay **154**. Furthermore, the load-management-control board **144** will continuously monitor the current in the relay **154** such that the load-management-control board **144** can determine if opening relay **154** will allow sufficient power to be supplied to the A/C **162** by closing relay **150**. If there is sufficient power capacity to run the A/C **162**, the load-management-control board **144** will open the relay **154** to disconnect power from the hot water heater **164**, and will close the relay **150** to activate the A/C **162**.

Furthermore, after the relay **150** has detected the activating signal, the power that can potentially be drawn by the load through the relays **150** and **154** is further examined. Once the total power that can potentially be drawn by the A/C **162** and the hot water heater **164** has been determined, the load-management-control board **144** determines if the available power is enough to power the A/C **162** while keeping the relay **154** closed. If the power is insufficient for the A/C **162**, the load-management-control board **144** will keep the relay **150** open regardless of the status of the relay **154**.

Still furthermore, the load-management-control board **144** will also be constantly monitoring the current at the relay **154**. In this way, the load-management-control board **144** can determine if opening the relay **154** will provide sufficient power to close the relay **150**. If the load-management-control board **144** determines that opening up the relay **154** can provide sufficient power to the A/C **162**, the relay **154** is opened or turned off. When the relay **154** is opened, the power is discontinued from the hot water heater **164**, and the relay **150** is closed or turned on to provide power to the A/C **162**.

FIG. **4** depicts a second exemplary load management system **400** disposed in the residence of FIG. **1**. The second exemplary load management system **400** includes a main breaker panel box **404** that is connected to a transfer switch **408**, and a plurality of loads. In the embodiment depicted in FIG. **4**, the loads include an air conditioner **412** and a hot water heater **416**. Particularly, the main breaker panel **404** is connected to the air conditioner **412** via a local disconnect **420**, and to the hot water heater **416** via a contactor **424**. The transfer switch **408** receives the utility power through a watt-hour-meter **428** and a service-disconnect **432**. The transfer switch **408** also receives power from a generator **436**. Furthermore, the main breaker panel **404** can also be connected to a plurality of circuits via some branch circuit outlets **440** in a known manner. In the embodiment depicted in FIG. **4**, the transfer switch **408** also includes the load-management-control board **144** (see FIG. **2**). However, the load-management-control board **144** can also be implemented or installed in the main breaker panel box **404**, in some other embodiments.

FIG. **5** depicts a third exemplary load management system **500**. The third exemplary load management system **500** also includes a transfer switch **504** that is connected to a main breaker panel box **508** and a generator **512**. The main breaker panel **508** receives utility power via a watt-hour-meter **516**. The transfer switch **504** is also connected to an emergency load center **520**. The emergency load center **520** is connected to a plurality of loads through contactors or a local disconnect. For example, the emergency load center **520** can be connected to a hot water heater **524** via a contactor **528**. For another example, the emergency load center **520** can be connected to an air conditioner or an air conditioning unit **532** via a local disconnect **536**. The emergency load center **520** can also be connected to other circuits via a plurality of circuit outlets **540**. In the embodiment depicted in FIG. **5**, the load-management-control board **144** is installed in the transfer switch **504**. However, the load-management-control board **144** can also be implemented in the emergency load center **520**, in some other embodiments.

FIG. **6** includes a flow chart **600** that further illustrates processes that occur in some embodiments including processes that may be carry out by software, firmware, or hardware. At block **604**, the load-management-control board **144** turns on a green light-emitting diode ("LED") at block **604**, when the utility power is present. The load-management-control board **144** then sets the contactor **170** (of FIG. **1**) in the utility position at block **608**. The load-management-control board **144** also turns off the green LED, when the utility power drops below a preset percentage of the utility voltage at block **612**. In some embodiments, the preset percentage is about 70 percent when the utility voltage is 240 volts. Although the flowchart **600** calls for a green LED, other LED's or other indicators can also be used.

At block **616**, the load-management-control board **144** checks to see if the generator **436** or **512** needs to be warmed up, depending on a jumper setting on the load-management-control board **144**. When the utility power drops below the preset percentage, and the jumper settings on the load-management-control board **144** are set for a specific generator warm up, the load-management-control board **144** starts to warm up the generator for a first preset amount of time at block **620**. In some embodiments, the first preset amount of time is about 20 seconds. However, if the jumper settings on the load-management-control board **144** are not set for a specific generator warm up, the load-management-control board **144** starts to warm up the generator **436**, **512** for an alternate preset amount of time at block **624** in default. In some embodiments, the second preset amount of time is about 50 seconds.

The load-management-control board **144** checks the fuel switch and jumper settings as indicated in FIG. **3** at block **628**. Particularly, the load-management-control board **144** checks to determine if the fuel switch and jumper settings are in the LP position at block **628**. If the fuel switch settings are in the LP position as determined at block **628**, and if the generator rating is 12 KW as determined at block **632**, the load-management-control board **144** presets a power or current rating for the generator **436**, **512** at about 50 Amps at block **636**. If the current rating for the generator **436**, **512** is set in a 15 KW position as determined at block **640**, the load-management-control board **144** then sets the current rating for the generator **436**, **512** at 62.5 A at block **644**. However, if the generator **436**, **512** is not in the 15 KW position or the 12 KW position as determined at block **640**, the load-management-control board **144** sets the generator **436**, **512** at other amounts of current at block **648**. For example, the amount of current can be 41.7 A if the generator **436**, **512** is rated at 10 KW. For another example, the load-management-control board **144** can set the current rating for the generator **436**, **512** at 70.8 A if the generator is rated at 17 KW. However, if it is determined at block **628** at the fuel switches are not at the LP position, the load-management-control board **144** then checks to determine the fuel switches setting to determine if the setting is at 12 KW at block **652**. If the generator rating is set at 12 KW as determined at block **652**, the load-management-control board **144** then sets the current rating of the generator **436**, **512** at about 40 A at block **656**. However, if the generator rating is set at 15 KW as determined at block **660**, the load-management-control board **144** sets the current rating at about 50 A at block **664**. Otherwise, if the generator rating is not set either at 12 KW or at 15 KW, the load-management-control board **144** sets the current rating at other amounts at block **668**.

As depicted in FIG. **6***a*, which is a continuation of the flow chart **600** in FIG. **6**, the load-management-control board **144** then checks the generator voltage at block **672**. If the generator voltage is above a second preset percentage as determined at block **672**, the load-management-control board **144** starts a delay such that the generator **436** or **512** can be warmed up before power is transferred to the gen-

erator **436** or **512** at block **676**. However, if the generator voltage is not above the second preset percentage as determined at block **672**, the load-management-control board **144** checks to determine if the utility voltage is above the second preset percentage at block **680**. If the utility voltage is not above the second preset percentage as determined at block **680**, operation at block **672** is repeated. Otherwise, if the utility voltage is above the second preset percentage as determined at block **680**, the green LED is turned at block **688**, the load-management-control board **144** starts a delay for about 10 seconds to determine if the utility power is stable at block **689**, and checks to determine if the delay has elapsed at block **690**.

Once the load-management-control board **144** has started the delay before transferring power to the generator **436**, **512** at block **676**, the load-management-control board **144** checks to determine if the utility voltage is above the second preset percentage at block **684**. If the utility voltage is above the second preset percentage as determined at block **680** or at block **684**, the load-management-control board **144** turns on the green LED at block **688**. However, if it is determined that the utility voltage is not above the second preset percentage at block **684**, the load-management-control board **144** continues to check if the generator **436**, **512** warm up time at block **692** has run out. If it is determined at block **692** that the warm up time for the generator **436**, **512** has not run out, the load-management-control board **144** continues or repeats block **684**. If it is determined at block **692** that the warm up time has run out, the load-management-control board **144** again checks to determine if the generator voltage is above the second preset percentage at block **696**. If it is determined at block **696** that the generator voltage is not above the second preset percentage, the load-management-control board **144** repeats the block **684**. Otherwise, if it is determined at block **696** that the generator voltage is above the second preset percentage, the load-management-control board **144** opens both of the relays **150**, **154** for a third preset amount of time at block **700**. The load-management-control board **144** also turns on a red LED at block **700**. In some embodiments, the third preset amount of time is about five minutes.

Referring back to block **690**, if the delay has not elapsed, the load-management-control board **144** checks to determine if the generator **412**, **536** has warmed up for an amount of time at block **701**. If the generator **412**, **536** has warmed up for the amount of time as determined at block **701**, the load-management-control board **144** starts the operation at block **696**. Otherwise, if the generator **412**, **536** has not warmed up for the amount of time as determined at block **701**, the load-management-control board **144** keeps the contactor **170** (of FIG. **2**) at the utility position at block **702**, and repeats block **604**.

Continuing with reference to block **700**, the load-management-control board **144** then checks to determine if both of the CT's **192**, **194** are present at block **704**. If it is determined at block **704** that the CT's **192**, **194** are absent from the load-management-control board **144**, the load-management-control board **144** keeps both of the relays **150**, **154** open at block **708**. Thereafter, the load-management-control board **144** transfers the contactor to the generator position at block **712**. However, if the CT's **192**, **194** are present at block **704**, the load-management-control board **144** starts to transfer the contactor **170** to the generator position at block **712** and keep the contactor **170** at the generator position at block **716** for a minimum amount of time. In some embodiments the minimum amount of time is about five minutes.

As depicted in FIG. **6***b* which is a continuation of the flow chart **600** of FIG. **6***a*, if the minimum amount of time has elapsed as determined at block **720**, the load-management-control board **144** performs a plurality of operations. For example, the load-management-control board **144** continues to check if the CT's **192**, **194** are present at block **724**, and checks if the utility voltage is above the second preset percentage at block **728**. If it is determined at block **728** that the utility voltage is above the second preset amount of percentage, the load-management-control board **144** will allow an amount of time (for example, 10 seconds) for the utility power to stabilize, and turns on the green LED at block **732**. However, if the utility voltage has not returned to the second preset percentage as determined at block **728**, blocks **724** and **728** are repeated. If it is determined at block **724** that the CT's **192**, **194** are absent, the load-management-control board **144** will open both relays **150**, **154**.

However if it is determined at block **724** that the CT's **192**, **194** are present, the load-management-control board **144** will carry out a series of operations discussed below. If the load-management-control board **144** has determined that the amount of time for the utility to stabilize has elapsed at block **740**, the load-management-control board **144** opens up both of the relays **150**, **154** for an amount of time, for example five minutes.

Because the utility has returned to above the second preset percentage and the pre-selected amount of time has elapsed for the utility power to stabilize, the load-management-control board **144** then moves the contactor **170** from the generator position back to the utility position, and turns off a red LED when the generator voltage is less than the second preset percentage at block **748**. Once the relays **150**, **154** have been opened for the amount of time set by the load-management-control board **144** as determined at block **752**, the load-management-control board **144** closes the relay **150** at block **756**. Otherwise, the load-management-control board **144** will wait until the amount of preset time to elapse (that is, repeats block **752**).

Once the relay **150** is closed, or in the CLOSED state at block **756**, the load-management-control board **144** starts to wait for a fourth preset amount of time at block **760**. In some embodiments the fourth preset amount of time is about 5 seconds. The load-management-control board **144** then waits for the fourth preset amount of time to elapse at block **764**. Once the fourth preset amount of time has elapsed as determined at block **764**, the load-management-control board **144** then closes the relays **154** at block **768**, and resets the recorded current values of the relays **150**, **154** at block **772**. The load-management-control board **144** then repeats the operation starting at block **612**.

Referring to FIG. **6***c*, which is a continuation of the flow chart **600** of FIG. **6***a*, and referring back to blocks **704** (FIG. **6**) and **724** (FIG. **6***a*), when the load-management-control board **144** has determined that the CT's **192**, **194** are present, the load-management-control board **144** determines if an appropriate amount of time has elapsed at block **776**. In some embodiments, the appropriate amount of time is about five minutes. Once the appropriate amount of time has elapsed as determined at block **776**, the load-management-control board **144** checks to determine if the A/C unit **412** is about to start at block **780**. If the A/C unit **412** is about to start as determined at block **780**, the load-management-control board **144** checks to determine if starting the A/C unit **412** will result in a total current demand being less than a specific amount, for example 85 percent at block **784**. In some embodiments, the total current demand can be determined by adding the current demanded by the A/C unit **412**

unit to a difference between the actual current available from the generator **436** and the current demanded by the hot water heater **416**. If it is determined at block **784** that the total current demand is less than the preset amount, the load-management-control board **144** checks to determine if the relay **154** is open at block **788**. Otherwise, if the total current demand is not less than the preset percentage as determined at block **784**, or if the A/C unit **412** is not about to start, the load-management-control board **144** starts operating at block **828** (FIG. **6***e*) as discussed below. If it is determined that the relay **154** is open at block **788**, the load-management-control board **144** closes the relay **150** at block **792**. If it is determined at block **788** that the relay **154** is not open, the load-management-control board **144** carries out other operations as discussed below.

If it is determined at block **796** that the current demand is greater than a percentage (for example, 85 percent) of the rated generator current, the load-management-control board **144** continues to check if the current demand is greater than the total rated generator current at block **800**. If it is determined at block **800** that the current demand is more than the total rated generator current, the load-management-control board **144** opens the relay **150** and records a current difference between the current drawn when the relay **150** is closed and the current drawn when the relay **150** is open at block **804**. However, if it is determined at block **800** that the current demand is less than the total rated generator current, the load-management-control board **144** waits for a preset amount of time, for example five seconds, for the loads to stabilize at block **808**. Once the load-management-control board **144** has waited for the preset amount of time as determined at block **812**, the operation in block **804** is repeated. Otherwise, if the load-management-control board **144** has not waited for the preset amount of time, the load-management-control board **144** continues to check the current demand at block **796**.

Referring to FIG. **6***d*, which is a continuation of the flow chart **600** of FIG. **6***c*, after the relay **150** is open at block **804**, the load-management-control board **144** continues to determine the current difference at block **816**. Particularly, if the current difference is less than a preset amount (for example, 5 A) at block **816**, the load-management-control board **144** assigns a previously determined current value to the relay **150** at block **820**. Otherwise, if the current difference is not less than the preset amount, or after the load-management-control board **144** has assigned the previously determined current value to the relay **150** at block **820**, the load-management-control board **144** starts a delay, for example five minutes, at block **824**. Thereafter operations in block **776** are repeated.

Referring to FIG. **6***e*, which is a continuation of the flow chart **600** of FIG. **6***d*, if the current demand is less than the preset percentage of the rated generator current as determined at block **796** (of FIG. **6***c*), the load-management-control board **144** checks to determine if it is a first rating check at block **828**. If it is determined at block **828** that it is the first rating check, the load-management-control board **144** waits for a set amount of time, for example five seconds, for the loads to stabilize at block **832**. The load-management-control board **144** then checks to determine if the A/C unit is about to start at block **836**. If the A/C unit is not about to start as determined at block **836**, the load-management-control board **144** checks to determine if a set amount of time (for example 5 seconds) has elapsed at block **840**. However, if the A/C unit is about to start as determined at block **836**, the load-management-control board **144** checks to see if closing the relay **150** will result in the current drawn being less than a preset amount of current, for example 85 percent, at block **844**. If it is determined at block **844** that closing the relay **150** will not result in the current drawn being less than the preset amount of current, block **840** is repeated. Otherwise, if it is determined at block **844** that closing the relay **150** will result in the current drawn being less than the preset amount of current, the load-management-control board **144** checks to determine if the relay **150** is closed at block **848**. If it is determined at block **848** that the relay **150** is closed, block **840** is repeated. If it is determined at block **840** that a delay (for example 5 seconds) has not elapsed, block **836** is repeated. Otherwise, if it is determined at block **840** that a delay (for example 5 seconds) has elapsed, the load-management-control board **144** checks to determine if the current demand is at most equal to a second difference between a percentage (for example 85 percent) of the rated generator current and the current value at the relay **154** at block **852**. If the current demand is not less than the second difference, block **836** is repeated. Otherwise, if the current demand is less than the second difference, the relay **154** is closed at block **856**. In this way, both of the relays **150**, **154** are in a CLOSED state. As a result, power can be supplied to both the A/C unit and the hot water heater.

Referring back to block **828**, if it is determined at block **828** that it is not the first rating check, the load-management-control board **144** checks to determine if the A/C unit is about to start at block **860**. If the A/C unit is about to start as determined at block **860**, the load-management-control board **144** checks to determine if closing the relay **150** will result in the current drawn being less the preset current percentage (for example 85 percent) at block **864**. If it is determined at block **864** that the A/C unit is not about to start as determined at block **860**, or closing the relay **150** will not result in the current drawn being less the preset current percentage, the load-management-control board **144** repeatedly checks to determine if a time delay, for example five minutes, has elapsed at block **868**. If it is determined at block **868** that the time delay has elapsed, the load-management-control board **144** checks to determine if the current demand is less than the second difference at block **872** as described earlier. If it is determined at block **872** that the current demand is not less than the second difference, block **860** is repeated. Otherwise, if the current drawn by the load as determined at block **872** is less than the second difference, block **856** is repeated.

Once the relay **154** is closed, or in the CLOSED state, the load-management-control board **144** determines if the relay **150** is in the CLOSED state or closed at block **876**. If the relay **150** is not closed, as determined at block **876**, the load-management-control board **144** determines if the current demand is greater than the preset percentage of the rated generator current at block **880**. If it is determined at block **880** that the current demand is at most equal to the percentage rated, the load-management-control board **144** checks to determine if the A/C unit is about to start at block **884**, and determines if starting the A/C unit can result in the current demand being less than the preset percentage at block **888**. If the A/C unit has not called to start as determined at block **884**, or starting the air conditioning unit is not less than the difference, block **880** is repeated. If the current demand is greater than the percent rated as determined at block **880**, the load-management-control board **144** checks to determine if the current drawn by the load is greater than the total current rated at block **892**.

If it is determined at block **880** that the load current is less than the preset amount, at block **884** that the A/C unit is

about to start, and at block **888** that starting the A/C unit can result in the current drawn being less than the preset percentage, or at block **892** that the current demand is greater than the total rated generator current, the load-management-control board **144** opens the relay **154** and records the current difference between the closed state and the open state of the relay **154** at block **896**. If, however, if the current demand is less than the total rated generator current as determined at block **892**, the load-management-control board **144** starts a delay (for example 5 seconds) for the load to stabilize at block **558**, waits the delay to elapse at block **558**, and repeats block **896** or repeats block **550** (will be detailed below) depending on the elapse of the delay determined at block **562**. The load-management-control board **144** then determines if the current difference is less than some preset amount (for example 5 A) at block **900**. If it is determined at block **900** that the current difference is less than the preset amount, the load-management-control board **144** assigns a previously determined current value to the relay **154** at block **904**. Otherwise, if the current difference is greater than or equal to the preset amount, as determined at block **900**, the load-management-control board **144** starts a delay (for example five minutes) at block **908**, and repeats block **780** after the delay. Referring back to block **876** that if the relay **150** is not closed, block **880** is repeated.

At block **550**, the load-management-control board **144** checks if the A/C unit is about to start. The load-management-control board **144** also checks if starting the A/C unit can result in the current drawn being less than the preset amount at block **554**. If closing the relay **150** can result in the current drawn being less than the preset amount as determined at block **554**, block **896** is repeated. If closing the relay **150** can not result in the current drawn being less than the preset amount as determined at block **554**, block **880** is repeated.

Referring to FIG. **6***f* which is a continuation of the flow chart **600** of FIG. **6***e*, and to block **876** that if the relay **150** is closed, the load-management-control board **144** checks to determine if the current demand is greater than the preset percentage of rated generator current at block **912**. If the current demand is greater than the preset percentage of rated generator current as determined at block **912**, the load-management-control board **144** checks to determine if the current demand is greater than the total rated generator current at block **916**. Otherwise if the current demand is less than the preset percentage of rated generator current as determined at block **912**, the load-management-control board **144** checks to determine if the A/C unit is about to start at block **920**. If the A/C unit is not about to start as determined at block **920**, block **804** is repeated. Otherwise, if the A/C unit is about to start as determined at block **920**, block **912** is repeated.

If it is determined at block **916** that the current demand is greater than the total rated generator current, the load-management-control board **144** opens the relay **154** and records the current difference at block **924**. If the current difference is less than the preset amount as determined at block **928**, the load-management-control board **144** assigns a previously determined current value to the relay **154** at block **932**. Otherwise, if the current difference is not less than the preset amount as determined at block **928**, the load-management-control board **144** starts a delay, for example five minutes, at block **936**. Thereafter, the load-management-control board **144** repeats block **780**.

Referring back to block **916**, if the current demand is not greater than the total rated generator current, the load-management-control board **144** waits for a preset amount of time, for example five seconds, for the loads to stabilize at block **940**, and checks to determine if a delay (for example 5 seconds) has elapsed at block **944**. If the delay has elapsed as determined at block **944**, block **924** is repeated. Otherwise, if the delay has not elapsed as determined at block **944**, the load-management-control board **144** checks to determine if the A/C unit is about to start at block **948**. If the A/C unit is about to start as determined at block **948**, block **912** is repeated. Otherwise, if the A/C unit is not about to start as determined at block **948**, the load-management-control board **144** repeats block **804**.

Thus, the invention provides, among other things, a load management system. Various features and advantages of the invention are set forth in the following claims.

What is claimed is:

1. A method of managing one or more electrical loads of a residence with a load management system configured to be powered by a residential generator, the residence having a thermostat and an air-conditioning system and further having a load unrelated to the air-conditioning system, the load management system having a first signal-responsive switch connectable in circuit between the residential generator and the load, the load management system further having a second signal-responsive switch connectable in circuit between the thermostat and the air-conditioning system, the method comprising:

closing the first signal-responsive switch to permit a current from the residential generator to the load;

receiving a call from the thermostat requesting conditioned air, including receiving the call at the second signal-responsive switch;

interrupting the call with the second signal-responsive switch;

opening the first signal-responsive switch to prevent the current from the residential generator to the load based on receiving the call;

providing the call to the air conditioning system, including closing the second signal-responsive switch; and

closing the first signal-responsive switch based on the cessation of the call.

2. A method as set forth in claim **1** wherein the method further comprises generating a signal and applying the signal to the first signal-responsive switch, and wherein the closing the first signal-responsive switch is in response to the applying the signal.

3. A method as set forth in claim **2** wherein the method further comprises generating a second signal after receiving the call and applying the second signal to the first signal-responsive switch, and wherein the opening the first signal-responsive switch is in response to the applying the second signal.

4. A method as set forth in claim **1** wherein the providing the call occurs after the opening the first signal-responsive switch.

5. A method as set forth in claim **1** wherein the method further comprises determining whether the residential generator can power both the air-conditioning system and the load after the receiving the call and determining whether the residential generator can power the air-conditioning system after receiving the call, and wherein the opening the signal-responsive switch occurs when the residential generator cannot power both the air-conditioning system and the first load, but can power the air-conditioning system.

6. A method as set forth in claim **1** wherein the signal-responsive switch comprises a relay.

7. A load management system for managing one or more electrical loads of a residence, the residence having a

thermostat, an air-conditioning system, and a load unrelated to the air-conditioning system, the load management system configured to be powered by a residential generator, the load management system comprising:

a first signal-responsive switch adapted to be connected in circuit between the residential generator and the load, the first signal-responsive switch configured to permit a first current from the residential generator to the load;

a second signal-responsive switch configured to be connected in circuit between the thermostat and the air-conditioning system, the second signal-responsive switch configured to permit a second current from the thermostat to the air-conditioning system; and

a controller connected to the first signal-responsive switch and to the second signal-responsive switch, the controller being configured to

open the second signal-responsive switch,

close the first signal-responsive switch to permit the first current from the residential generator to the second load,

receive a call from the thermostat requesting conditioned air,

open the first signal-responsive switch to prevent the first current from the residential generator to the load based on receiving the call, and

close the second signal-responsive switch to permit the second current from the thermostat to the air-conditioning system, thereby providing the call to the air-conditioning system.

8. A load management system as set forth in claim **7**, wherein the controller is further configured to, after providing the call,

receive a cessation of the call from the thermostat to cease the request of conditioned air,

open the second signal-responsive switch to prevent the second current from the thermostat to the air-conditioning system after the receiving the cessation, and

close the first signal-responsive switch to permit the current from the residential generator to the load after the opening the second signal-responsive switch.

9. A load management system as set forth in claim **7**, wherein the load management system further comprises a sensor adapted to sense first and second electrical signals associated with the load and the air-conditioning system, respectively, wherein the controller is further connected to the sensor, and wherein the controller is further configured to

determine, after receiving the call, whether the power required from the residential generator for both the air-conditioning system and the load would exceed a preset value, the determination being based on the first and second electrical signals,

determine whether the residential generator can power the air-conditioning system after the receiving the call without exceeding the preset value, the second determination being based on the second electrical signal, and

open the first signal-responsive switch when providing power to both the air-conditioning system and the first load would exceed the preset value, but powers the air-conditioning system and not powering the load would not exceed the preset value.

10. A load management system as set forth in claim **9**, wherein the sensor comprises a first current transformer associated with the load and a second current transformer associated with the air conditioner.

11. A load management system as set forth in claim **7**, wherein the first and second signal-responsive switches comprise first and second relays, respectively.

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